Helicopters

test and development of the helicopter "dunking" sonar, and a weapon designed specifically for the helicopter. If necessary, effort should be diverted from other developments* (already in progress).

The design and development of improved aircraft carriers suitable for all weather flying be resumed (already in progress).

ASW Aircraft

AD and AF airplanes be equipped with (the) APS-33 (radar) and evaluated by OPDEVFOR as "single package" ASW airplanes, and . . . construction of a new carrier ASW airplane await the result of this evaluation. (The new carrier aircraft design was not held up.)

That all CVEs in the Reserve Fleet be retained.

Sensors

That all means of detection and localization, including Magnetic Airborne Detectors (MAD), sonobuoys, "dunking" sonar, towed sonar, and infra-red detectors, be pursued vigorously. (Within funding limitations this was being done.)[50]

In summary, the Undersea Warfare Study--the Low Report--concluded in April, 1950, two months before the Korean War, that the ASW techniques and equipment in use by the U.S. Navy were adequate to defeat the conventional WWII type submarine, which was basically the kind of submarine fleet the Soviets had at that time.

* The study concluded that the helicopter could prove to be an important screening craft of the future. By placing it at a sufficient distance ahead of a convoy, it could detect submerged submarines before they could effectively fire their long-range torpedoes. Thus, while the helicopters themselves could not be torpedoed, they could move the sonar barrier out from the task force. Furthermore, they could be employed on the thirty-six small "Kaiser"-class CVEs in the Reserve Fleet which were of marginal value for operating fixed wing aircraft. These carriers would provide excellent seagoing mobile operating bases for ASW-configured helicopters. Even if a CVE were lost in convoy escort, its helicopters could conceivably continue to operate from the surrounding merchant vessels.

What It All Means

The period between World War II and the Korean War proved to be the most stringent of the postwar phases covered, especially in terms of available money. The Navy, concerned about the potential Soviet submarine threat, now that the Russians had acquired the latest German technology, moved to update its successful Hunter-Killer team concept, building around the new CVE 105 class but still using adaptations of the TBM aircraft. The refined HUK groups worked well against the World War II submarine, which was required to perform much of its mission on the surface, but poorly against the new Guppy/Type XXI classes capable of snorkeling and 16 knot underwater speeds. The available sensors--radar, visual, and intelligence--were still most effective against a threat on or near the surface. Exercise after exercise proved that a determined postwar submarine could not be stopped before reaching firing position.

The creation of the Department of Defense and the subsequent assignment of the strategic air role to the Air Force combined with this submarine problem to force a refinement of the Navy's war plans. These now emphasized stopping the submarine threat before it got to sea by neutralizing shipyard and basing facilities, then laying mines in the many restricted areas through which the Soviets had to pass, and only as a last resort countering the threat with tactical ASW forces at sea. This concept required development of the postwar attack carrier and improvements in land-based air if it were to work. This was in addition to the arduous development of new methods of submarine detection, localization, and classification.

Organizationally, Op-31 was created to coordinate all ASW activities for the CNO. This office proved ineffective because of limited power, and was modestly strengthened in 1948, still serving, however, primarily as a coordinating agency. In 1948 the CNO did strengthen ASW within the fleets by assigning overall operational responsibilities to the two Fleet Commanders in Chief. This then created a "troika" version of the World War II TENTH Fleet with the two fleets now responsible for overall operational ASW, and OPNAV handling planning and development. Intelligence was developed by all three.

As far as sea-based airborne antisubmarine warfare was concerned, this five year period saw the growth of the postwar Hunter-Killer concept; the realization of its limitations; and the gradual introduction of updated versions of existing ASW aircraft. The helicopter slowly continued to look better as the years passed, primarily as it and its dipping sonar continued to develop. Some ASW capability was placed on the carriers with the arrival of the first modified ADs. In general there was a pervasive concern that airborne ASW could not counter the postwar (high underwater speed, snorkeling) submarine threat. The Navy could handle the World War II threat, however, and as this period closed, it appeared that that was the kind of submarine force the Soviets were developing.

References

1. CNO Secret Letter to SecNav, 5 January 1946, Op-34C, File S3, Serial 00119P03, Record Group 38, Washington National Records Center. (Hereafter cited as W.N.R.C.)

2. Secret Memorandum, Resume of the Conference held in the Navy Department on Anti-Submarine Warfare Measures, 28 Feberuary 1946, Op-312 File A19-1(1), Record Group 38, W.N.R.C., pp. 5-6.

3. CNO Top Secret Letter, 7 June 1946, Op-34, File A16-3, Serial 0007P34, Record Group 38, W.N.R.C.

4. CNO Top Secret Memorandum for distribution list, Proceedings of Anti-Submarine Warfare Conference, 17 June 1946, File A16-3(2), Serial 00012P34, Command File, Operational Archives Branch, Naval History Division. (Hereafter cited as NHC/AR).

5. Secret Air Intelligence Division Study, Office of Naval Intelligence, "Vulnerability of USSR Submarines and Supporting Facilities to Air Attack," 29 October 1946, Op-312 File, Record Group 38, W.N.R.C., Appendix A.

6. Proceedings of Anti-Submarine Warfare Conference, 17 June 1946, pp. 5-6.

7. Proceedings of Anti-Submarine Warfare Conference, 17 June 1946, p. 8.

8. Anti-Submarine Conference, 19-20 September 1946, Op-31C, File A3-2, Serial 0014P31, Command File, NHC/AR, pp. 86-87.

9. Op-31 (Coordinator of Undersea Warfare) Secret Memorandum for Op-01, Op-02, Op-04, Op-05, "Implementation of Recommendations of Anti-Submarine Conference of 19-20 September 1946," 18 December 1946, Op-31C, File A19-1 (1), Serial 0034P31, NHC/AR, p. 8.

10. "Implementation of Recommendations of Anti-Submarine Conference of 19-20 September 1946," 18 December 1946, p. 12.

11. Presentation to the President, 14 January 1947 VADM Forrest Sherman, U.S. Navy, DCNO (Operations), CNO Chronological Command File, NHC/AR.

12. Sherman, Presentation to the President, p. 6.

13. Minutes of Second Anti-Submarine Conference, 30 September - 1 and 2 October 1947, OP-413, Command File, NHC/AR.

14. Minutes of Second Anti-Submarine Conference, 30 September - 1 and 2 October 1947, p. 206.

15. Minutes of Second Anti-Submarine Conference, 30 September - 1 and 2 October 1947, pp. 205-206.

17. Minutes of Second Anti-Submarine Conference, 30 September - 1 and 2 October 1947, pp. 8-9.

18. Minutes of Second Anti-Submarine Conference, 30 September - 1 and 2 October 1947, p. 180.

19. General Board, "National Security and Navy Contributions Thereto, A Study by the General Board," 25 June 1948, G.B. 425, Serial 315, NHC/AR.

20. General Board, pp. 6-7.

21. General Board, pp. 11-12.

22. Minutes of the Third Anti-Submarine Conference, 28, 29 and 30 September 1948, Command File, NHC/AR, p. 156.

23. John T. Tate Secret Letter to Forrestal, 7 May 1948, Op-312, File A3, Record Group 38, W.N.R.C.

24. RADM Styer Top Secret Memorandum to CNO,, 14 May 1948, Op-31, File A16-3(17), Record Group 38, W.N.R.C, p. 9.

25. Forrestal to Tate, undated, Op-312, File A3, Record Group 38, W.N.R.C.

26. VADM A.D. Struble Top Secret Memorandum for Admiral Denfeld, undated, Op-312, File A16-3, Record Group 38, W.N.R.C.

27. CNO Secret Memorandum for CINCLANTFLT and CINCPACFLT, 9 July 1948, Op-31, A16-3, Serial 117P31, Record Group 38, W.N.R.C.

28. RADM C.B. Momsen Secret Memorandum for CNO, 13 June 1949, Op-31, File A3, Serial 00215P31, Record Group 38, W.N.R.C.

29. Secretary of Defense Forrestal Memorandum to Sec Nav, 26 September 1948, Op-312, File A3, Record Group 38, W.N.R.C.

30. Captain Herbert D. Riley Memorandum to RADM Momsen, 27 September 1948, Op-312, File A3, Record Group 38, W.N.R.C.

31. Paul Y. Hammond, "Super-Carriers and B-36 Bombers: Appropriations, Strategy, and Politics," American Civil-Military Decisions, ed. Harold Stein (Tuscaloosa: University of Alabama Press, 1963), pp. 553-555.

32. Minutes of Fourth Anti-Submarine Conference, 28 November to 2 December 1949, Command File, NHC/AR, pp. 14-15.

33. Minutes of Fourth Anti-Submarine Conference, 28 November to 2 December 1949, p. 25.

34. Minutes of Third Anti-Submarine Conference 28-30 September 1948, p. 10.

35. Minutes of Fourth Anti-Submarine Conference, 28 November to 2 December 1949, p. 170.

36. Minutes of Third Anti-Submarine Conference, 28-30 September 1948, p. 116.

37. Minutes of Third Anti-Submarine Conference, 28-30 September 1948, p. 122.

39 Informal Anti-Submarine War Training Board Report, VADM Francis S. Low, Chairman, 21 September 1948, Command File, NHC/AR.

40 Minutes of Fourth Anti-Submarine Conference 28 November - 2 December 1949, p. 189.

41. Minutes of Fourth Anti-Submarine Conference, 28 November - 2 December 1949, p. 200.

42. Minutes of Fourth Anti-Submarine Conference, 28 November - 2 December 1949, p. 189.

43. Minutes of Fourth Anti-Submarine Conference, 28 November - 2 December 1949, p. 190.

44. Minutes of Fourth Anti-Submarine Conference, 28 November - 2 December 1949, p. 190.

45 Minutes of Fourth Anti-Submarine Conference, 28 November - 2 December 1949, p. 175.

46. Minutes of Fourth Anti-Submarine Conference 28 November - 2 December 1949, pp. 260-261.

47. Study of Undersea Warfare, 22 April 1950, Serial 001P003, NHC/AR.

48. Study of Undersea Warfare, p. 1.

49. Study of Undersea Warfare, p. 1.

50. Study of Undersea Warfare, pp. 17-29.

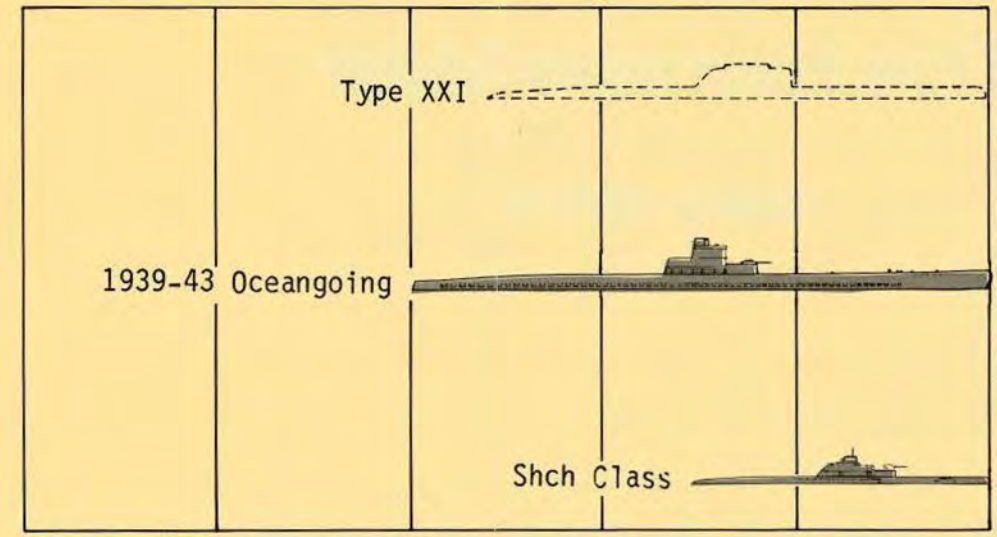
CHAPTER III

The Korean War

1951-1954

The Korean War demonstrated how unready the Navy was to conduct antisubmarine operations against a serious submarine threat. The escort carriers, first used to support the Marine ground forces in Korea, proved inadequate once they turned to ASW. Budgets as a result of the war increased, however, and the Navy moved to larger ASW carriers, newer aircraft, and the helicopter. The ASW organizations in the fleets were strengthened and, most significantly, the SOSUS detection nets planned for the continental offshore areas, began development. Project Hartwell at the beginning of this period made a number of far-reaching recommendations affecting sea-based airborne ASW and the CVS-based HUK group came into being at the end.

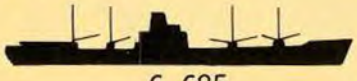
THE THREAT 1950-1954



	Displ.	Speed
Type XXI	1,600	15
	2,200	16
1939-43 Oceangoing	1,957	20
	2,002	10
Shch Class	620	15.5
	740	8.5

TYPICAL MERCHANT SHIPS - 1952

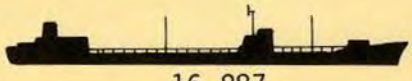
Freighter



540 ft

6,685

Tanker



620 ft

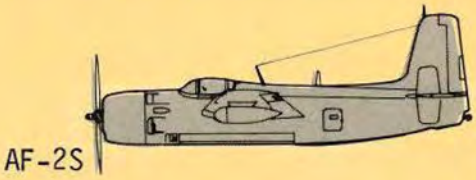
16,887

Average of New Construction - DWT Tons

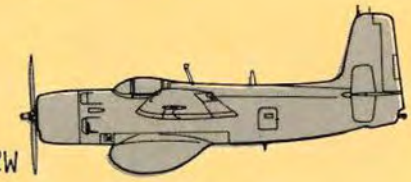
S-B|A
ASW

The Korean War

SEA-BASED AIRBORNE ANTISUBMARINE AIR, 1951-1954

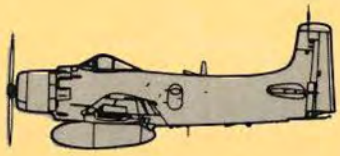


AF-2S

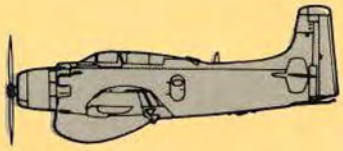


AF-2W

Gross Wt 25,500 lbs
Vmax 317 mph



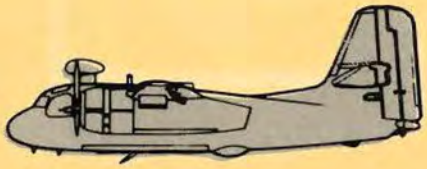
AD-4N



AD-4W

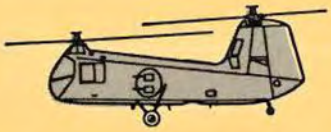
Gross Wt 18,263 lbs
Vmax 321 mph

S2F-1



Gross Wt 26,867 lbs
Vmax 253 mph

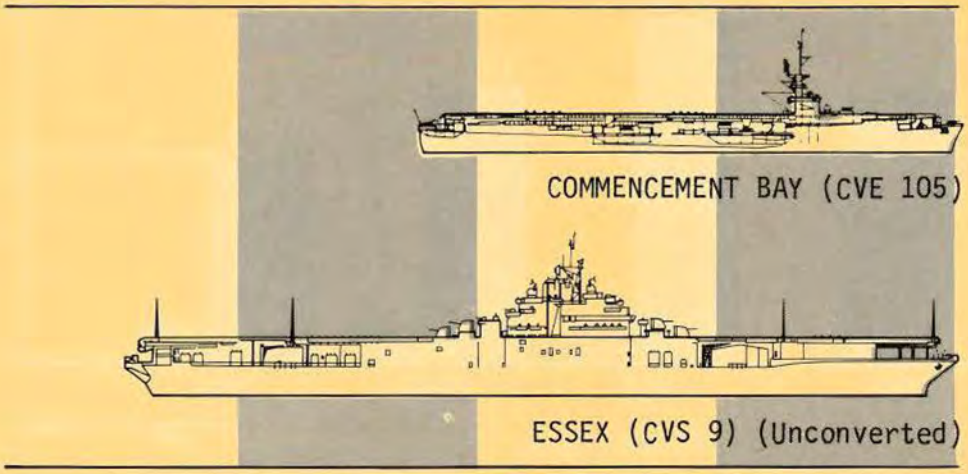
HUP-2



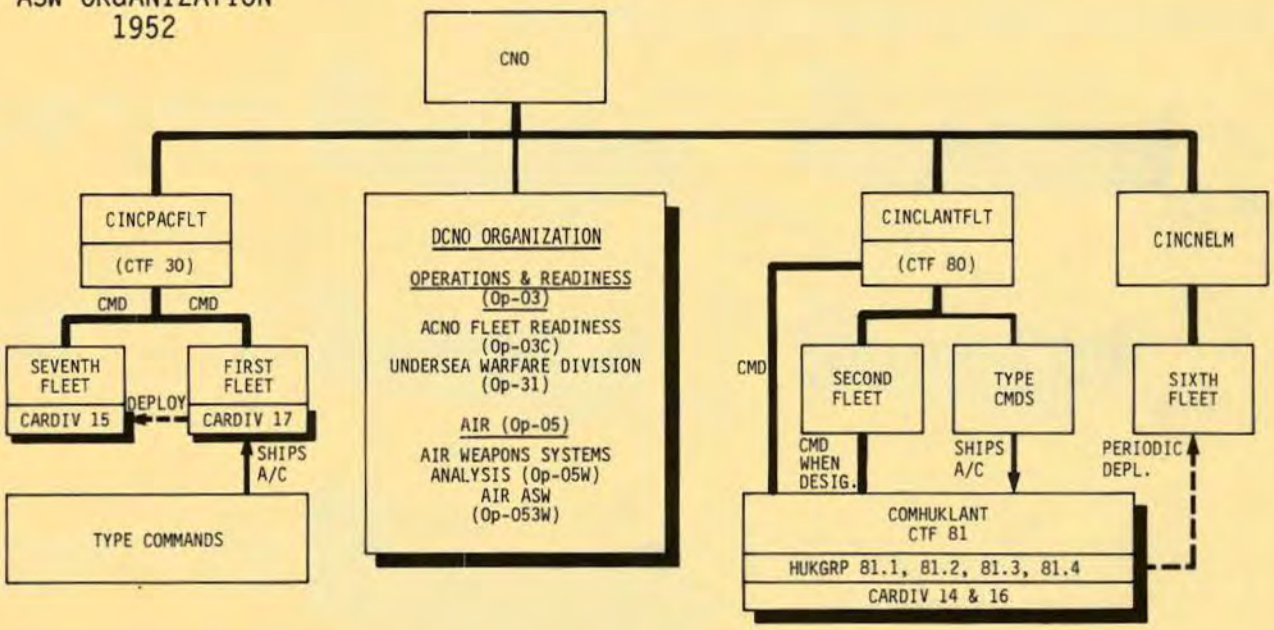
Gross Wt 5,440 lbs
Vmax 105 mph

HO4S

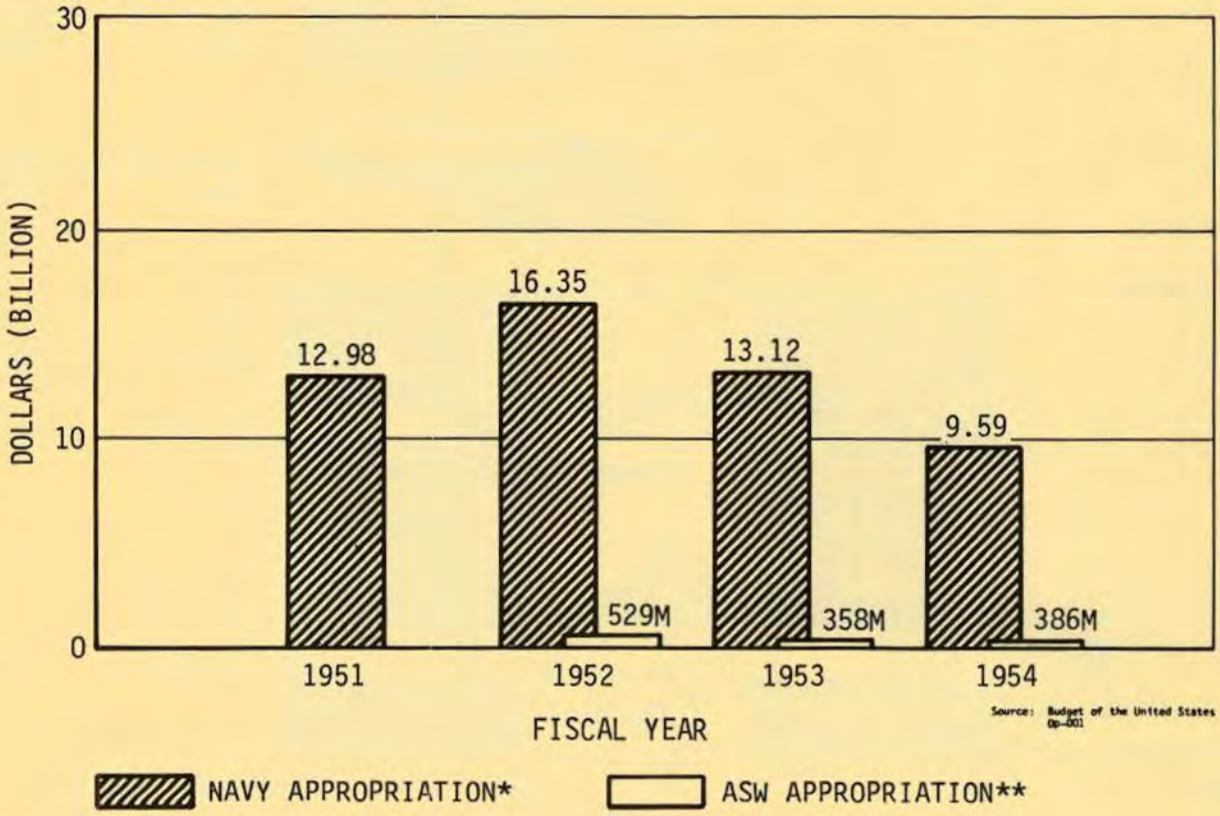
Gross Wt 7,900 lbs
Vmax 101 mph



ASW ORGANIZATION 1952



FINANCIAL SUMMARY



* Includes total Navy appropriation.

** Includes only aircraft, weapons, shipbuilding and conversion, and other procurement.

The Korean War

The Navy Reacts to the North Korean Invasion--Airborne ASW Developments

25 June 1950

With North Korea's invasion of South Korea on 25 June 1950, the U.S. Navy's postwar problems stemming from the stringent postwar austerity programs were brought into sharp focus. Most important were those which emphasized the deficiencies in training and equipment, much of the latter not having changed since World War II. These conditions were particularly true in ASW where numbers of ships and aircraft were at an absolute minimum.

At the time of the invasion CINCPAC estimated that a total of seventy-eight Communist submarines were operating in the Far East which were in a position to constitute a threat to the UN forces.[1] The latter were being hastily assembled under General Douglas MacArthur to resist the North Koreans' progress south, and all reinforcements moving to Korea had to go by sea; as a result unimpaired use of the sea lanes was an urgent requirement. Initially only one fast carrier, the *Valley Forge* (CV 45) with COMCARDIV 3, was available in the SEVENTH Fleet to provide air support to the hard-pressed ground forces. With her air group was a small contingent of ASW-designated AD-4W and AD-4N Skyraiders, Hunter-Killers representing the sole carrier-based airborne ASW capability in the Korean area.

The AD-4N and AD-4W Are the First ASW Aircraft on the Scene

Beyond this the airborne ASW forces in WESTPAC consisted of two patrol squadrons, VP 47 (PBM-5) and VP 28 (PB4Y-2) and three squadrons of destroyers (DESRON 3, 9, and 11), which were able to provide limited sonar coverage. According to CINCPAC, this escort and screening was "accomplished on a ship available basis and was grossly inadequate as far as sufficient ASW protection was concerned."[2] Only a little over a third of the Navy's active

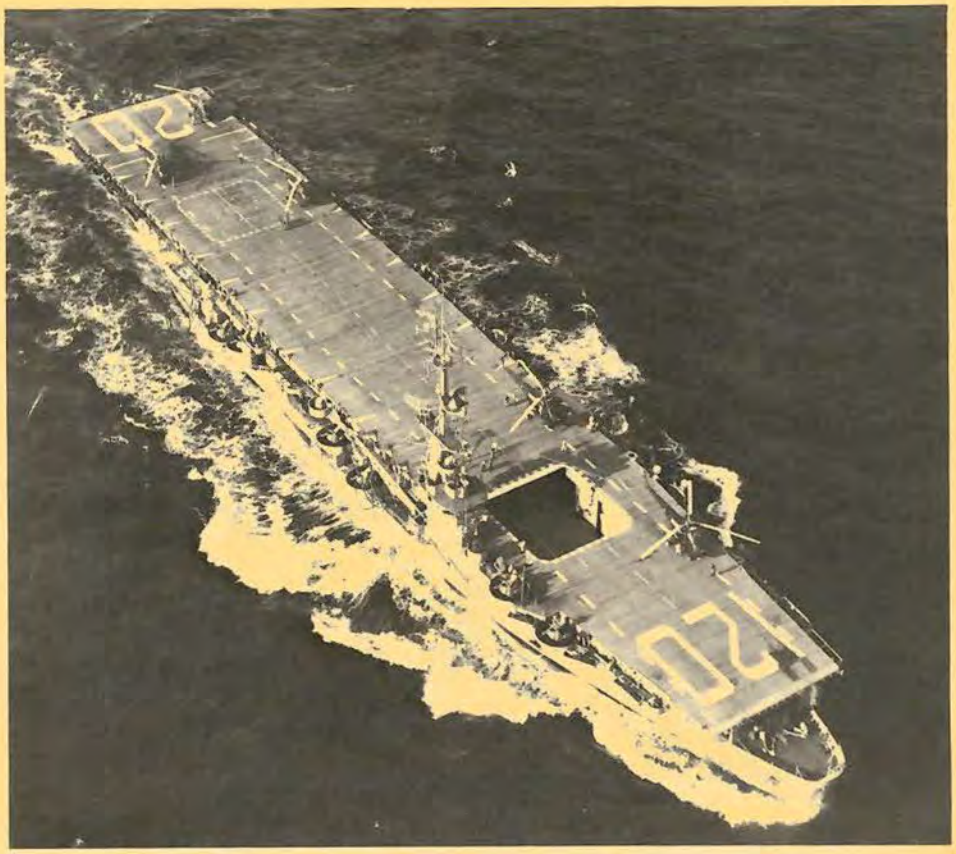
Other ASW in Korea

Philippine Sea *(CV 47)* and Valley Forge *(CV 45) were configured like this when the Korean War started. Note the AD-4Ws on the starboard bow and amidships. Basic complement consisted of ADs and F9Fs.*

strength was in the Pacific and only a fifth of that was in the Far East. These forces came under Vice Admiral Turner Joy, Commander Naval Forces, Japan (TF 96), who on 27 June 1950 issued Operation Order 5-50, the basic naval directive for the Korean campaign. On 17 July this order was further amplified to provide guidance on handling the projected ASW threat: "Unidentified submarines in the vicinity of friendly surface forces are considered a threat to our operations and will be attacked and driven off by any means available."[3] This was elaborated upon by secret dispatch 040256Z of August 1950 which stated:

Korean War Antisubmarine Policy

> Unidentified submarines may be attacked and driven off by any means available in self defense or when offensive action against our forces is indicated. In interpretation of the foregoing, continued submergence of an unidentified submarine in position to attack our forces operating against North Korea or in support of the assigned mission with regard to Formosa is considered to indicate offensive action against our forces.[4]



RFC/AL

The CVE 105 class escort carrier Mindoro *with Marine HRS helicopters on deck. The Navy's first operational helicopter was the HO4S, a near sister.*

The Escort Carriers Arrive...

The escort carriers *Sicily* (CVE 118) and *Badoeng Strait* (CVE 116) of ASW Carrier Division 15, the only two CVE 105 class ships then active in the Pacific, were immediately deployed to WESTPAC, arriving in Japan on 31 July with eighty-nine aircraft of Marine Air Wing ONE.* Leaving responsibility for antisubmarine patrols and Hunter-Killer operations to the patrol planes of Task Force 96.2,** these ships were destined to spend most of the remainder of 1950 in their alternate postwar role of providing decks for Marine air support squadrons. Accordingly, on 8 August

* The escort carriers *Sicily* and *Badoeng Strait* when operating in their ASW roles supported VS 25 and VS 21 respectively as their ASW air groups, each consisting of sixteen TBM-3 "killer" and four TBM-3W "hunter" aircraft.

** Which consisted initially of eight PBMs, three Sunderland flying boats, nine P2V-3s and one small seaplane tender.

... But Do Not Conduct ASW Operations

CARDIV 15, now designated as Task Group 96.8, arrived off the southwest coast of Korea just one week after the arrival of the second fast attack carrier, *Philippine Sea* (CV 47).* TG 96.8's duties, in descending order of priority, were to "provide close air support for ground troops in Korea and conduct air strikes against North Korean military targets and installations as directed; conduct Hunter-Killer operations as directed by COMNAVFE. . . ."[5] Thus, the exigencies of the moment--the need for tactical air strikes against the invading North Korean forces--reduced ASW to a secondary role which effectively became nonexistent. This was a decision difficult to change since no active submarine threat developed during this period. Although there were over eighty submarine sightings reported from all sources during the first five months of the war, only two of these were positive identifications, one of which was friendly. Thus, in CINCPAC's view, *Badoeng Strait*'s and *Sicily*'s "ASW function could be disregarded temporarily in favor of providing mobile operating bases for Marine squadrons supporting ground operations on the Korean peninsula."[6] During this period VS 21 remained in readiness at Guam while the *Badoeng Strait* (CVE 116) operated F4U aircraft in support of the Marines.

The Escort Carriers Show Their ASW Limitations

CVE ASW Finally Begins November 1950

On 13 November 1950 *Sicily* finally began ASW training after disembarking VMF 214. During the June to November period, however, the Navy's Evaluation Group wrote that while the CVEs of the *Commencement Bay* class were excellent logistically in maintaining air operations, they were too slow in moving long distances (18.5 knots versus 30-plus for the CVs), were thus wind-over-the-deck limited, and were physically too small.[7] This last made night operations hazardous as well. They concluded:

> Certain inherent limitations of this ship . . . seriously reduce its potential . . . for the future. Even with World War II aircraft, operations were critical under no wind conditions. . . . Indications are that recently designed aircraft (the AF and the S2F) will be prohibitively susceptible to this limitation.[8]

By 8 October four *Essex* class carriers, *Valley Forge* (CV 45), *Philippine Sea* (CV 47), *Boxer* (CV 21) and *Leyte* (CV 32) had reported as CARDIVs 1, 3 and 5 of Task Force 77.

A New 25 Knot Escort Carrier Design Study

Acutely aware of these deficiencies even before the outbreak of the Korean War, Op-312 (Undersea Warfare) had proposed the construction of a new prototype 25 knot CVE. A design study had been authorized at the Newport News Shipbuilding Company on 20 April 1950. This ASW carrier would have been capable of operating new and improved ASW aircraft such as the AF and S2F.[9] With the move toward the redesignation of the unconverted *Essex* class carriers to CVS, this new prototype CVE never progressed beyond the design study stage. Since the latter would not be completed for at least five years, installation of new arresting gear (Mk-5) and new catapults (H-4) in the CVE 105 was recommended. It was further suggested that the usefulness of the CVE class for ASW operations might be prolonged by converting them into helicopter carriers (CVHE), a role

The AD-4S and AD-4W fast carrier Hunter-Killer team. Note the radar pod, Mk 34 torpedo and combined sonobuoy-searchlight pod under the wing of the strike aircraft.

ultimately undertaken by the modified CVE 55 class carrier *THETIS BAY* (CVHA 1) during the late fifties for the amphibious forces.

ASW On the Fast Carriers

ASP Operations on the Fast Carriers

As noted previously, the fast carriers in Korean waters each carried a detachment of three or four AD-4W (or AD-4E) aircraft which served in the ASP* role during the dawn hours, forming Hunter-Killer teams in company with the AD-4Ns on board, the latter occasionally alternating with the F4U-5NL Corsair night fighter.** However, the TBM teams on the CVEs were considered more effective due to the lack of time available to conduct ASW training on the fast carriers. There the AD-4W aircraft's primary function was airborne early warning, not ASW. As CINCPAC concluded:

> The VA(W) and VA(N) units of the Fast Carrier Task Force were inadequately trained for ASW missions at the time of their deployment from West Coast bases. The lack of training opportunities in the forward area prevented overcoming this handicap.[10]

The fast carriers' problems initially were further complicated by the fact that the AD sonobuoy dispensers could only carry the new SQQ-2 which had been delayed in delivery to the fleet and thus were not available in the quantities required. In summary it was CINCPAC's assessment that:

> If the Soviets had unleashed an unlimited submarine campaign (during this period), the Naval Air ASW organization would have been unable to handle it because of insufficient forces available and because of the poor material condition of the ASW equipment.[11]

1951

Permanent Hunter-Killer Operations in the Korean Area

TG 96.7 is Formed - the First WESTPAC Hunter-Killer Group

On 23 January 1951 Carrier Division FIFTEEN became TG 96.7 with primary responsibility for Hunter-Killer operations as directed by Commander Naval Forces Far East. The task group was composed of two destroyer divisions and the

* Antisubmarine Patrol.

** The normal AD-4N ASW loading included SSQ-2 sonobuoys, one or two Mk 54 depth bombs and four solid head rockets. The F4U-5NL carried one Mk 54 and four or six rockets. Both carried flares for night illumination.

TBM-3W2 search aircraft.

TBM-3S strike aircraft.

single CVE 105 class escort carrier *Bairoko* (CVE 115) with VS 21 embarked,* she having relieved her two sisters, *Sicily* (CVE 118) and *Badoeng Strait* (CVE 116).[12] Each division of eight destroyers were to be rotated on a six week basis in order to maintain ASW readiness. Thus TG 96.7 became the Navy's western Pacific Hunter-Killer group, located in the Korean area with primary responsibility for maintaining the SEVENTH Fleet's ASW proficiency, often in coordination with submarines assigned to provide ASW localization and classification training. By 30 April, ten months after the start of hostilities, this group "within the capabilities of its equipment had attained a high degree of readiness." It is interesting to note that the lack of destroyers, plus their marginal sonar performance in these exercises, led to the suggestion that sonar screens be extended by "utilizing helicopters equipped with sonar for this purpose."[13] The Korean War period would see the operational introduction of the ASW helicopter by 1953.

The Activities of Land-Based Air Patrol

Operationally, daily reconnaissance flights were maintained in the Tsushima Straits and Yellow and Japan Seas, with ASW barriers established when directed. These, however, were conducted by the patrol squadrons of COMFAIRWING SIX which were flying a combination of PBM-5S, PBM-5, P2V-3, P2V-3W and PB4Y-2S aircraft, the S series carrying MAD. During early 1951 an adequate supply of SSQ-2 sonobuoys finally became available. The main weapon carried during this period was the Mk 54 aircraft depth bomb. Mk 24 mines were stocked but not normally carried on patrol.

* VS 21 was relieved on 19 February 1951 by VS 23 which was equipped with twelve TBM-3S and six TBM-3W aircraft.

ASW Progress in Korea 1951, 1952

During the first ten months of the war there had been ninety-six "submarine" contacts (two positive, eight probable) while over the next eight months there were eighty-eight, six of which were positive, all outside the Korean operating areas. TG 96.7 continued in its ASW training role. In addition, one CVE and one CVL (*Bataan* (CVL 29)) operated off the West Coast as TE 95.11, alternating with British Commonwealth carriers, each generally with Marine fighter squadrons embarked. Their operational experience as expressed in the Evaluation Reports indicated that while the CVL 22 and CVE 105 classes were either relatively versatile (the CVL 22) or economic (the CVE 105), both had limitations "which would seriously affect their ability to operate modern fighter and attack aircraft."[14] All actual combat experience revolved exclusively around support of forces ashore during this period.*

1952

From 1952 on, sea-based airborne ASW in Korean waters was limited to the training activities of Hunter-Killer Group TG 96.7, with the various CVE 105 escort carriers

RFC/AL

USS **Bataan** *(CVL 29), June 1951.*

* Captain J.S. Thach, followed by Captain W. A. Schoech, each commanded *Sicily* (CVE 118) and TE 95.11 during this period.

alternating between this role and combat for three months at a time.* There was no aggressive enemy submarine activity although contacts were periodically developed. Had there been hostile submarine action, and there was continual concern, CINCPACFLT Instruction 003-60.2A of February 1952 provided the policy to be pursued:

Routine ASW Operations

> . . . The use of submarine warfare by Communist forces is an ever present threat. It is imperative that full details of aggressive acts by unidentified submarines reach CINCPACFLT as soon as possible. Careful consideration has been given to the "Action to be taken" by our forces in the various circumstances under which they come in contact with unidentified submarines. Instructions are purposely made general, . . . in order to permit the exercise of sound judgement by responsible officers on the scene. Enclosure (1) is issued for their guidance. It is summarized briefly as follows:
>
> "(a) An unidentified submarine will be attacked by all means available under the principle of SELF DEFENSE when:
>
> "1. It attacks friendly forces anywhere.
>
> "2. It continues to remain submerged in a position to attack our forces operating against North Korea or in support of the assigned mission in regard to Formosa.
>
> "3. It attempts submerged penetration of a U.S. controlled port or harbor.
>
> "(b) An unidentified submarine contacted under any other circumstances shall not be attacked but will be tracked and attempts will be made to establish its identity."[15]

How to Handle the Threat - Updated

While the state of ASW readiness was considered satisfactory, ASW forces remained insufficient and the destroyer's sonar detection ranges had "improved but little

Poor Ship Sonar Performance

* The AS squadron would remain with the HUK group during the former's entire WESTPAC tour, moving between escort carriers as necessary.

in 15 years. All too often in unrestricted exercises the initial contact with a submarine did not occur until the latter fired torpedoes or was at such short range that the submarine could not be prevented penetrating the screen."[16] This led to increased pressure for new surface ship sonars with significantly greater ranges. Failing this, as stated before, there was heightened interest in the sonar carrying helicopter.

The CVE 105 and its Limitations

1952

As the war progressed, the CVE 105 found few supporters. PACFLT's assessment in early 1952 was:

> The CVE is rapidly reaching the obsolescent stage. The ASW plane such as the AF requires a larger and faster carrier for reliable operations. Under light wind conditions operations become dangerous and operational losses increase. Such losses would hardly be acceptable under wartime conditions. The CVE is incapable of covering a fast convoy except under unusually favorable wind conditions. The CVL would qualify as a more suitable ASW carrier with respect to speed but would be hampered by fuel limitations. It appears that the *Essex* class CVA would be the ideal ASW carrier, having fuel capacity sufficient for the required endurance of itself and escorts, speed to handle modern ASW planes under any wind conditions, size to handle any type ASW carrier plane and in sufficient numbers to remain on a Hunter-Killer operation for long operations and hunt submarines to exhaustion. The *Essex* class CVA used as an ASW escort carrier would be able to carry enough VF in addition to her ASW aircraft to enable her to drive off long range enemy reconnaissance aircraft.[17]

The ESSEX Class As ASW carriers

The Combined Air/Submarine Threat

A Carrier Plan for the Future

In May 1952 Rear Admiral H.E. Regan, COMCARDIV 17, recommended that no further money be wasted on trying to improve these obsolete vessels. He strongly advocated that steps be taken to improve the carrier problem along the following longer range lines:

New Attack Carriers

a. Drive vigorously and continuously for a new-construction program of *Forrestal* class ships to the end that an orderly replacement program of fully adequate carriers exists and is recognized in all circles as a necessity.

ESSEX Class Carriers for ASW

b. Immediately activate presently mothballed CV 9s. Substitute them on a one for one basis for CVE 105's now in active service. This will result in an immediate increase in ASW readiness, alleviate the usual shortage of adequate decks for training, and replace a carrier (CVE) which cannot today perform its major mission satisfactorily by one (CV 9) which can perform most of today's duties adequately.

c. As CV 27 conversions report to the fleet retire the CV9's replaced thereby to ASW duties in replacement for CVE/CVL's on one for one basis.

d. In the future, should the number of *Forrestals*, CVBs, and 27 conversions exceed the allowed strength in the fast carrier forces retire 27 conversions to active duty in the ASW forces to the end that, within the numbers allowed, the carriers in active service are the most modern and most versatile.

CVEs as Transports

e. Consider the CVEs as possibly useful in the future for transport duties and as platforms from which helicopters can operate, if and when their use becomes feasible in ASW and Marine assault operation. Inactivate them as replaced. Incorporate in them no changes or alterations not consistent with their future usefulness.[18]

Late 1952 VALLEY FORGE Exercises as a CVS

These far-sighted recommendations summarized exactly the course the Navy would shortly take. Admiral A.W. Radford, CINCPACFLT, concurred with RADM Regan's recommendation for a prototype CVS. As a result VALLEY FORGE (CVA 45) in late 1952 participated in a Hunter-Killer exercise off the California coast. The participants concluded that:

Valley Forge *(CVA 45) around the time of her ASW experiment. Note the AF aircraft on the flight deck.*

Its advantages were manifold over the CVE/CVL types. There was ample room for two VS squadrons on board. The wide winged AF had sufficient deck space and a carrier that could easily give it safe launch speeds even in a dead calm. All in all the advantages of the larger flight and hangar decks, speed stronger arresting gear and catapults, greater elevator capacity were in marked contrast to . . . the CVE/CVL type.[19]

The AF Guardian Hunter-Killer Team Makes Its Debut

By 1951 the Navy was finally getting new ASW fixed wing carrier-based aircraft to replace its World War II conversions. The long-awaited Grumman AF Hunter-Killer team was beginning to reach the fleet, replacing the older TBMs on the CVEs. While offering more performance, these aircraft were over 8,000 pounds heavier than the TBMs they replaced. Unfortunately, the performance of the new Grumman AF aircraft on the CVEs was marginal. According to Captain C.B. Lanham, CINCLANTFLT ASW Staff, "We have spent more money in air crashes than justify the use of the 105 class." [20]

ECM Progress

In addition, the use and importance of ECM was growing. In 1952 VS 871, flying AF aircraft, was the first deployed VS squadron in the Pacific to be fully provided with its authorized allowance of passive intercept equipment. COMCARDIV 15 reported that:

The AF-2S ASW strike aircraft with fuel tank, rockets and searchlight.

The AF-2W ASW search aircraft with its prominent APS-20 radar.

RFCAL

Block Island *(CVE 106) loses an AF Guardian but saves a pilot August 1953.*

> Approximately one half of the positive submarine contacts by (these) aircraft developed from initial ECM detection. ECM presents the earliest possibility of submarine detection in antisubmarine operations. Submarine capabilities for sonar tracking of the HUK Group is frequently equal to the Group's radar detection range capability on the submarine. Development of EMCON procedures is proceeding.[21]

Development of EMCON Procedures

Bataan (CVL 29) and her escorts began tentative development of EMCON procedures in accordance with CINCPACFLT Instruction 03510.1 of 1 November 1952. There were communications and identification problems during the initial exercises and the results were generally unsatisfactory. However, the promise of success was evident with continued practice and refinement.

ASW in Korea, 1953--The Helicopter Arrives

By early 1953 the first ASW helicopters* had become operational which, along with ECM, had improved the Fleet's

* The ASW helicopter which had first reached Korean waters was the 7,900-pound Sikorsky HO4S (HRS-2) powered by one 700-hp Pratt & Whitney R-1340 engine and capable of 101 miles per hour at sea level.

Naval Institute

An HO4S-3, sister to the Navy's first operational ASW helicopters.

ASW capabilities. While the new ASW helicopter promised improved ASW capabilities, it also brought new questions regarding its compatibility with the existing CVE HUK concept. As RADM Regan, COMCARDIV 17, observed:

Impact of the Helicopter...

> The integration of the Dipping Sonar Helicopter as a coordinated component in the field of ASW appears to have far reaching implications in the development of new HUK concepts. It appears certain to influence existing air, surface and submarine tactics profoundly, at least in good weather and sea conditions.

And Its Dipping Sonar...

> From the limited experience and observations, the dipping sonar appears to possess a tremendous potential in . . .
>
> (a) Reduction of time late over datum. . . .
>
> (b) Positive and rapid identification of disappearing contacts. . . .

On ASW Operations

> (c) Tenacity in holding a contact. . . .
>
> (d) Reduction of the vulnerability of the SAU* as a torpedo target.
>
> (e) Ability to regain contact rapidly.

* Surface Attack Unit.

(However) it must be remembered that, without reducing conventional types a penalty is paid for the helicopters in CVE deck space, spotting complexities and in crowding more personnel aboard an already crowded ship.

Helicopter Limitations At Sea

The practical endurance of the HRS-2 (HO4S) allowing a 20-30 minute safety factor with dipping sonar equipment and crew is approximately 2-1/2 hours with maximum allowable fuel load; when dipping about half of this period. Under high temperatures and no wind conditions the fuel load must be reduced by as much as 400 lbs., reducing its endurance by about 1.3 hours. The short endurance and low air speeds limit the use of the HRS-2 to contacts within approximately 30 miles from the carrier, permitting only 1 hour in the contact area under average summer conditions in WESTPAC. These limitations effectively limit the movement of the carrier to a radius of thirty miles around the contact, and if additional time in the contact area is desired, it is necessary for the carrier to close the contact to an undesirable and sometimes dangerous degree. This restriction on the freedom of movement of the carrier is serious and must be eliminated.

Beginning of the LAMPS/DASH Concept

. . . . This suggests the requirement for a landing platform on the future escort vessels. Such a facility as visualized is only a platform of sufficient size to permit landing the smaller ASW helicopter and having some sort of quick attachable/detachable hold-down fittings to afford easy securing and releasing in a seaway. . . .

True Then, True Today

Such a facility would afford the carrier complete freedom of movement to avoid the danger area once the SAU arrived at the scene of contact as the helicopters could remain in the area with the SAU when only a small reserve of fuel remained, then land on the escort vessel and return to the carrier after the SAU returns to the formation. An increase in the time on station of the helicopters would also result. The sacrifice of one or more AA guns of the escort vessel for this capability would be acceptable if necessary.[22]

The End of the Korean War, July 1953

Armistice 27 July 1953

The hostilities in Korea officially ended on 27 July 1953 with the signing of the Armistice at Panmunjon. During the thirty-seven months of conflict there had been no submarine incident to actively test the United Nations' ASW capabilities. The predictions made by senior U.S. ASW planners prior to 1950, that in the event of an emergency the Soviets would launch a submarine offensive immediately, were proven to be erroneous.

The lessons of the Korean War as summarized in part by the final Pacific Fleet Evaluation Report were:

The War's Lessons

> Aggressive submarine action by the enemy would have necessitated a considerable revision of the pattern of operations in Task Forces 77 and 95. The lack of submarine opposition emboldened our forces to operate with a calculated risk day after day in the same areas, often at very slow speeds. Escort of heavy units and logistic groups continued on "an as available basis" and it was well recognized that this would have been entirely inadequate in the face of opposition.
>
> The readiness of our forces to conduct antisubmarine warfare was maintained by the training operations of the Hunter-Killer Group (TG 96.7). . . . Highly valuable training exercises were conducted which did much to increase the overall ASW readiness of all participating units. Exercises during the period emphasized once again that a single CVE was inadequate for convoy support operations, it being too slow to maintain proper position, and too small to carry sufficient aircraft. The helicopter quickly proved its worth and won a vital berth on the A/S team. Its addition aggravates considerably the overcrowded conditions on the CVE. The forthcoming ASW CVS is urgently required in the Hunter-Killer team.
>
> ECM continued to be the most effective means of initial detection of submarines and serves warning that the Hunter-Killer Group, too, must avoid indiscriminate use of radar.

CVE Inadequate

Helicopter Worthy

ECM for Initial Detection

> It is again worthy of note that the Hunter-Killer Group has always been commanded by a Carrier Division Commander. This command organization was a satisfactory one during the war period. It does appear, however, that in order to avoid developing Hunter-Killer operational techniques with a unilateral point of view, that command of this Group should be alternated between surface and aviation line officers, and that the remainder of the staff should also be so balanced.[23]

Command Broadened

The Essex Class Moves to the CVS Role — *1953*

In March 1953 nine CVs were being considered "at the highest level" for the CVS role.* In CAPT Lanham's view, the *Essex* class CV's size made its advantages obvious in more than just ASW: "When you are thinking of protection to shipping, you have an air attack to think of and the (Soviet long range bomber) TU4 can cover the Western Approaches. (The carriers) are going to have to carry their own fighters which is another argument for using the *Essex* class carriers unconverted."[24]

The Air Threat to ASW Operations

The British during the first six months of World War II had lost as much shipping in the Western Approaches to air attack as to submarines. Now, partly because of a decline in size of British naval forces, the United States was faced with increased responsibilities in maintaining the sea lines of communication to the United Kingdom. Commented Captain C.B. Lanman:

Decline of the British

> In the last war the British had an ASW capability, both surface and air. This time they (don't). We can't depend on their land based fighters. . . . If we are not going to do it with the *Essex* class carrier (in the CVS role) we are going to have to ask one of the attack carriers out of the Carrier Task Force and they have to do too much already.[25]

From the purely ASW point of view, the tests on the west coast with *Valley Forge* (CVA 45) confirmed the Navy's

* Ultimately on 8 August 1953 five CVs were designated as CVS: *Enterprise* (CVS 6), *Franklin* (CVS 13), *Bunker Hill* (CVS 17), *Leyte* (CVS 22) and *Antietam* (CVS 36), of which only the latter two were operational. On 1 January 1954 *Princeton* (CVS 37) and *Valley Forge* (CVS 45) were added to the list.

expectations regarding the *Essex* class carriers as CVS ships. As a result, three such ships had been assigned to the Atlantic Fleet by May 1954 and one in the Pacific.

Thus the reactivation of the unconverted *Essex* class and their conversion to CVS begun in 1953 was a direct outgrowth of the U.S. experience in the Pacific theater. The Korean War served as the catalyst that finally activated the Navy's carrier programs, setting the stage for the extensive carrier construction and conversion programs which would be carried out over the next decade.

1950

Project Hartwell

One significant impact of the Korean War on the Navy's antisubmarine efforts was to loosen the severe budgetary restrictions which had prevailed during the 1945 to 1950 period. This served to increase the Navy's ability to take advantage of the evolving technologies in ASW as well as to begin the modernization of its ships and aircraft. One focal point in establishing these advances was Project Hartwell, which was convened at the Massachusetts Institute of Technology in the summer of 1950. This study was originally proposed in a letter dated 23 January 1950 from G.P. Harnwell, Deputy Chairman of the Committee on Undersea Warfare of the National Research Council to Admiral C.B. Momsen, ACNO (Undersea Warfare). It recommended in part that the Navy develop a long range program to counter the submarine threat. Taken in its broadest sense, it was to include a review of transport and cargo handling, vehicle and weapon systems, and submarine defense. To help define such a program, the Committee on Undersea Warfare suggested a group of outstanding individuals with a high degree of technical, scientific, and operational competence. In following up these recommendations for the meeting, Admiral Momsen, along with Rear Admiral T.A. Solberg, Chief of the Office of Naval Research, met in New York with Dr. M.J. Kelly, Director of Research, and Dr. J.B. Fisk, both of Bell Telephone Laboratories, and Dr. J.A. Stratton, Provost of the Massachusetts Institute of Technology. There Dr. Stratton declared that "if the Navy felt that the advanced-type submarine presents such a critical national problem," MIT would conduct a long range study of the problem under the auspices of ONR. The CNO, Admiral F.P. Sherman, approved the resulting study recommendation, requesting that MIT start immediately.[26] Not only was the group to make recommendations, but also to guide future Navy long

Op-31, ONR, M.I.T. and the National Research Council

Study Approved by Admiral Sherman, CNO

range ASW/ASM planning, and to define new programs and organization. Thirty-three scientists participated during a three month period ending 31 August 1950. Project Hartwell, as it was now labeled, was conceived as a "short-term intensive assault on the technical barriers" that limited the effectiveness of antisubmarine and antimine warfare.* As the report itself states, however:

Thirty-three Participating Scientists

> From the outset, it was apparent that the group could not restrict its attention to antisubmarine and antimine warfare but must cover the broader problem of overseas transportation. . . .
>
> Because of the nature of the Project, the Hartwell Report does not profess to be exhaustive. Rather, it attempts:
>
> 1. To study the problems that confront the Navy in the performance of its responsibility to protect overseas transport and its own task forces;
>
> 2. To appraise the efficency of present planning and equipment to solve these problems;
>
> 3. To suggest and recommend means by which gaps may be filled and deficiencies remedied.[27]

Coming only a few months after the Navy's internal Study of Undersea Warfare,** MIT's Project Hartwell was in substantial agreement with the former's findings, differing only in certain specific conclusions and suggested means of implementation. Project Hartwell has generally been credited with providing the necessary impetus to SOSUS and other passive detection systems, as well as the creation of nuclear underwater weapons. In addition, it endorsed the continued development of the dipping sonar helicopter and the nuclear powered submarine.***

Project Hartwell and the Low Report

* Commander W.H. Groverman, Undersea Warfare Branch, ONR, later RADM Groverman, Op-07C, ASW R&D Programs, was assigned as Project Hartwell's liaison officer.

** Generally referred to as the Low Report, completed 22 April 1950, see Chapter 2, pp. 89-91.

*** For example, in 1970 Rear Admiral W.C. Abhau, Manager, ASW Systems Project (PM4), stated, "Project Hartwell in 1950 pointed the way to SOSUS and JEZEBEL."[28]

The Hartwell study group assumed that the adversary would be the Soviet Union which, by September 1952, could have a fleet of 200 to 300 submarines equivalent to the Type XXI with a construction capacity of 100 such submarines per year. Atomic weapons would be used by the Soviets against surface ships and ports, and there would be an aggressive Russian mining campaign, both submarine and air. It concluded, "The minimum effort that the U.S.S.R. can be expected to make against U.S. and allied shipping is serious."[29] The Report developed twenty-nine conclusions and recommendations, portions of which bear broadly on sea-based airborne ASW and was distributed for comment during the fall of 1950. Op-31, over the CNO's signature, directed that its recommendations, where appropriate, be accomplished through normal channels.[30] In May 1951 RADM Momsen's organization (ACNO Undersea Warfare) summarized the status of ASW development within the Navy covered by the Hartwell Report.[31] It replied point by point, as summarized below, after each Hartwell recommendation:

Hartwell's Recommendations and the Navy's 1951 Response

WEAPONS

ASW Nuclear Weapons

Project Hartwell

The use of underwater atomic weapons against submarines provides a means of obtaining a sure kill when identification is positive. Such an atomic explosive has, inherently, a large radius of action, sufficient to sink a submarine at least one mile distant from the point of detonation. Some of these weapons can and should be provided immediately.

Op-03

Development of tactical atomic weapons against submarines at sea is now being studied. Op-36 (Atomic Energy Division) has allotted $300,000 to BuOrd to conduct studies of naval application of atomic weapons. This is pointed at the requirement for an atomic depth charge.[32]

Deep-Water Test

Project Hartwell

For more accurate evaluation of an atomic ASW weapon, the Navy should proceed with plans for a deep-water test explosion with the bomb at a depth probably between 1,000 and 2,000 feet. The effect of a deep explosion upon sur-

face vessels (here the threat is principally against us) can be determined in the same test.

(This type of test was actively being explored.)[33] — *Op-03*

Military Planning

Too few Naval officers are adequately informed about the potentialities of atomic weapons, and the responsibility of planning for the use of atomic weapons is restricted to an even smaller group. Similarly, too little consideration is being given to defense against the use of atomic weapons by the U.S.S.R. — *Project Hartwell*

CNO (letter) of 11 August 1950 outlined the program for atomic energy indoctrination . . . the Ad Hoc Committee Report on the tactical use of atomic weapons (has been) disseminated by OPNAV.[34] — *Op-03*

U.S. Stockpile

The U.S. rate of production of fissionable materials should be increased immediately. The U.S. stockpile is already such that atomic weapons could be used tactically in large numbers. However, since the ASW weapon is only one of many conceivable important tactical applications, a larger stock of atomic explosives is highly desirable. — *Project Hartwell*

Increased production is a function of the Atomic Energy Commission. . . . Op-36 is taking all possible steps to promote increased production of fissionable material.[35] — *Op-03*

OTHER WEAPONS AND WEAPONS SYSTEMS

ASW Helicopters

The helicopter, as a vehicle invulnerable to torpedo attack, with a high search rate against submarines, the ability to operate with task forces, convoys, and fast independents, and to destroy submarines once contact is made, seems the most promising single weapon system — *Project Hartwell*

for antisubmarine warfare. The development of a suitable all-weather vehicle, an improved sonar, and a weapon should be accelerated.

Op-03

The development of a suitable all-weather helicopter, an improved sonar, light-weight weapon, communication and station-keeping navigation equipments, is being aggressively prosecuted. BuAer and BuOrd have requested additional funds in FY 1951 supplemental and FY 1952 R&D budgets to support all phases of this recommendation.

A project has been established in OPDEV-FOR to evaluate the helicopter/dipping sonar combination employing the HO4S helicopter and the AQS-4 dipping sonar. Difficulties have been encountered due to the marginal performance of the HO4S and malfunctioning of the AQS-4. Concerted efforts are being made to improve the operational reliability of the HO4S/AQS-4 combination but completion of the project will probably be delayed from 1 June until 15 September 1951.

*A contract has been let to Bell Aircraft Corporation for development of an all-weather helicopter that will satisfy operational requirements for an ASW mission. The first flight of the experimental model is scheduled for April 1952. One hundred fifty-four HUP-2, an interim ASW helicopter, are on order and are scheduled to start delivery in September 1951.**

*Contracts have been let and funds obligated for procurement of one hundred fifty-two AQS-4** dipping sonars; six hundred more have been budgeted for in the 1951 third supplement.*[37]

* None of the Bell designs would ever become operational in the ASW role.

** The AQS-4A operated in the 20-22 kHz frequency range; had an operating depth of 20 to 60 feet, with 30 degrees beam width. Its weight was 325 pounds and required one kilowatt of power to operate. It had a 15 inch dome, was searchlight type and scanned 360 degrees. It had a range of 4,700 yards with a shallow target in good water.[36]

Airborne Hunter/Killer Tactics

Project Hartwell

The search problem and the attack problem are different. A "single package" system in which one plane carries radar, localizing and identifying equipment and weapons, although it may have its tactical uses, represents a costly technical and tactical compromise. Parallel development of team tactics, utilizing one plane equipped with the best possible search radar, accompanied by planes equipped especially for investigation and attack, is strongly urged. The principal factor influencing the efficiency of search is radar performance. Every effort should be made to improve it, and nothing should be allowed to compromise radar performance in the search plane.

The attack plane should be equipped principally for identification, fire control, and weapon-carrying ability. In this connection, improvement of MAD, development of sonobuoys, wake detectors, and effective killing weapons are necessities. A nuclear-explosive antisubmarine weapon should be considered. Effective liaison between the attack and search units should be accomplished by a radar relay with video insertion. With this arrangement, the attack plane can be vectored without giving the submarine prior knowledge of the attack.*

Op-03

Today the "team" concept of a search aircraft teamed with an attack aircraft is a reality. The search aircraft is configurated with the best search radar, the APS-20, presently available. The attack aircraft is equipped with the best available identification, fire control and weapons. Action is being taken on improvement of MAD, development of sonobuoys, development of improved killing weapons and radar relay plus video insertion.

* The earlier Low Report also recommended continued development of the two plane airborne Hunter-Killer ASW team which, practically speaking, would disappear with the introduction of the S2F and the ASW helicopter.

The "team" concept will be maintained as long as the tactical situation demands, however, the force requirements favor a "single package" concept. The XS2F carrier ASW aircraft is being developed as a "single package" plane and, if successful, will greatly facilitate CVE operations by greater flexibility of embarked aircraft.[38]

Antisubmarine Submarines (SSK)

Project Hartwell

An antisubmarine submarine has certain unique advantages in the field of ASW, which make its development of great importance. It is capable of: (1) long-range listening; (2) all-weather operation, and (3) maintaining patrols in waters that are dominated by enemy aircraft. Results of recent experiments show that the use of large, low-frequency listening arrays may yield detection ranges of 100 miles or more on snorkeling submarines.

Op-03

*SSK tactics have been under development by COMSUBDEVGRP TWO for nearly two years and the SSK Manual is currently under revision within that command. . . . Considerable research is currently underway on the propagation of low frequency sound in the sea. . . . A contract has recently been negotiated by ONR with Bell Telephone Laboratory and their work already shows much promise.** [39]

DETECTION AND IDENTIFICATION

Sonar Development

Project Hartwell

There is a need for high-performance, specialized, single-purpose equipments; in particular: (1) low-frequency directional listening arrays; (2) echo ranging and listening from helicopters and special surface craft; (3) improved echo ranging for fire control; (4) echo ranging and listening from buoys, anchored or dropped from aircraft; and (5) listening gear for warning against torpedoes.

* See page 132-133 as well.

Op-03

Current FY 51 sonar development effort is represented by amounts totalling $3,000,000. Supplemental and FY '52 requests total $20,000,000. Single purpose developments have been emphasized in current and supplemental budgets in proportion to their estimated degree of promise.

With reference to the specific items mentioned: (1) The Bell Telephone Laboratory is making rapid progress in the development of low frequency, directional, shore based, listening arrays for very long range search. In addition, the U.S. Navy Underwater Sound Laboratory has one listening array installed in a submarine for test, while a second equipment is now being manufactured; (2) A helicopter-mounted, dipping sonar equipment is at present under evaluation, a second equipment is under development and two equipments for employment from blimps are in the late development stages; (3) Five separate sonar equipments, designed to provide fire control data for surface craft, are in the late development, construction or test stages; one employs FM, one a searchlight-SSI principle, one a UOL-small object location principle and two a combined horizontal-vertical scanning principle; (4) An omnidirectional aircraft sonobuoy is in production, a directional buoy is in the test stages and an echo-ranging buoy is in the development stage by the Bureau of Aeronautics; (5) Two types of listening equipment for torpedo warning in surface ships have been manufactured and are now ready for installation in a ship for sea test. The present QHB scanning sonar has shown promise as a torpedo listening equipment.[40]

Research on Sound in the Sea

Project Hartwell

The present scale of effort devoted to research and development in the sonar field must be greatly extended. In particular, a major program of basic research on the behavior of sound in the sea should be initiated promptly in order to guide the exploitation of low-frequency sound for long-range detection,

identification, tracking, communications and weapon guidance.

Op-03

During the past several years, BuShips has expended about $1,000,000 annually in this field, about one-third the total budget in underwater sound. BuShips intends to increase the effort markedly; ONR is increasing its effort and expects to employ additional talent at Columbia University, emphasizing the basic research projects.[41]

New Methods of Detection

Project Hartwell

Several new methods for detecting submarines have shown enough promise in brief trials to justify further investigation. These include infrared wake detection, sonic detection of bubbles in the wake, and trail detection by ions or condensation nuclei. Underwater electrical potentials, and bubbles in the wake, look promising for short-range identification. Wake detection by pH measurement should be investigated. Longer-range MAD, using paramagnetic resonance, looks very promising on paper.

Op-03

Sonic detection of bubbles in the wake is now in the study stage by NEL and the Applied Physics Laboratory, Johns Hopkins. Depending on the results of the study and subsequent recommendations, a contract will be let. Condensation nuclei and ion detection is being worked on by General Electric, Carnegie Research and NRL; ranges of 11,000 yards from the target have been obtained. UEP work is going on at NEL, USNUSL, Scripps Oceanographic Institute and Springer Aircraft - Radio. Wake detection by measurement of pH factor was investigated by the A.D. Little and Co. under contract; it was reported last fall that little promise lay in that direction. Paramagnetic resonance work is being carried out by the University of Chicago. Infrared wake detection is being done by BuAer, NRL, Baird Instruments, BelTel and BuStandards; current work shows promise, wakes having been detected out to 20,000 yards astern of the target at night.[42]

Direction Finding

The current development of an interim direction-finding network should be continued, but with changes that will permit some interception of flash signals. This system can be in operation by 1952 and will always serve to intercept normal transmission and slowed-down transmission which might defeat a network designed for detection of flash. — *Project Hartwell*

A considerable amount of effort is being put on DF of flash transmissions. Two methods, extensions of normal techniques, currently hold the most promise. In one, intercept methods with a high speed dual goniometer and Wallen-weber antenna should be effective against transmissions one-half second or more in length. The other which requires an intelligence estimate of the approximate probable frequency, utilizes a fixed antenna with antenna multicouplers and multiple receivers so that several frequencies could be guarded simultaneously.[43] — *Op-03*

Airborne Radar

Although the advance in radar techniques, represented by the APS-20 and subsequent developments, has nearly compensated for the initial advantage that the development of the snorkel gave to the submarine, radar performance is still marginal and snorkels will become harder to see in the future. For the future, the airborne radar program can and must be extended. — *Project Hartwell*

BuAer has requested additional funds in FY 1951 supplemental and FY 1952 R&D budgets to support all research phases of this recommendation. Additional APS-20 equipped aircraft are on order (as well as) nineteen PO2W aircraft with a large dish (17-1/2 feet by 4-1/2 feet) antenna.*[44] — *Op-03*

* Later redesignated the WV-2, deliveries of which started in 1954.

New-Type MAD

Project Hartwell

In the final stages of antisubmarine attack, it is so important to be able to locate a submerged submarine, and to identify it as such, that a vigorous effort to improve magnetic detection methods should be made. Present MAD, already highly developed, cannot be much improved, but magnetic detection utilizing paramagnetic resonance looks promising enough to warrant further investigation.

Op-03

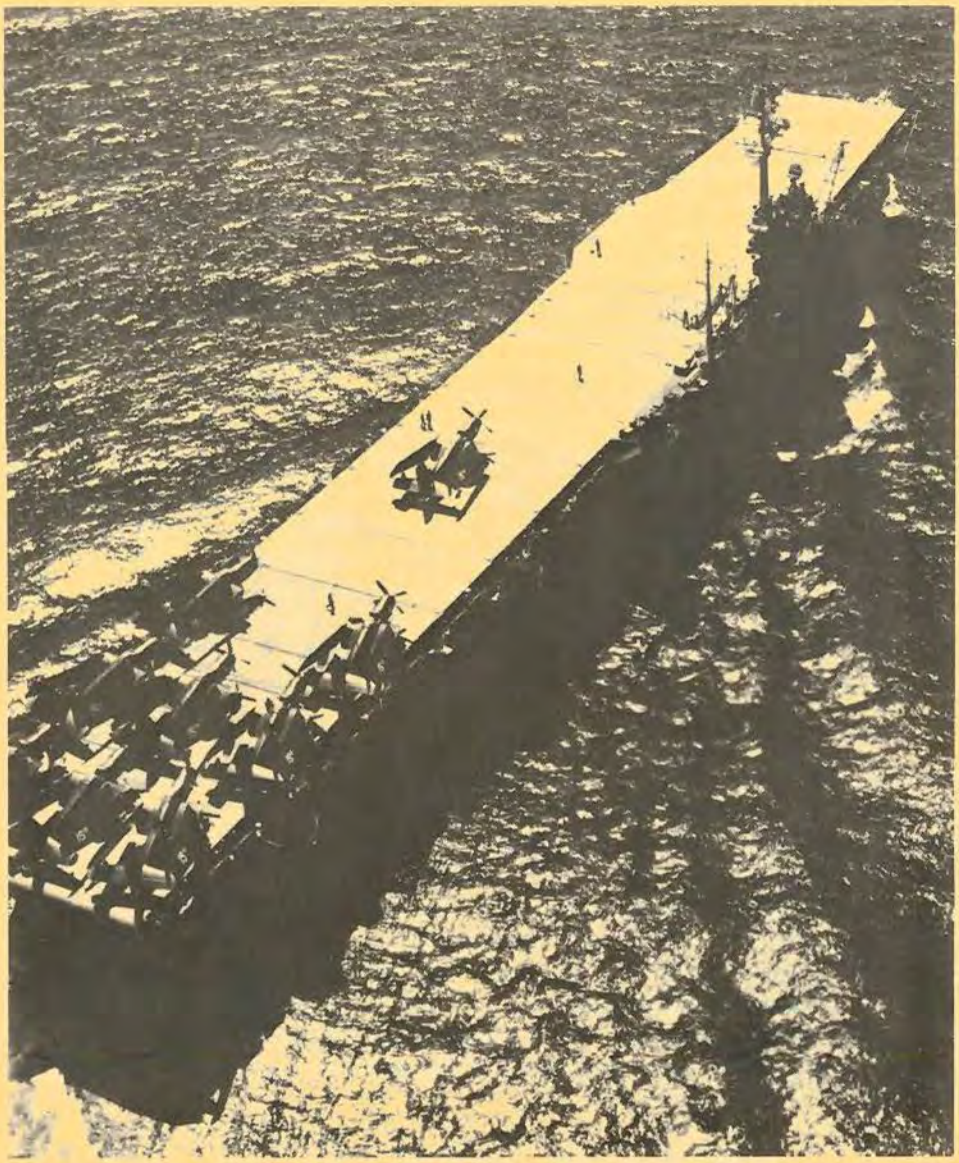
A recent conference between interested offices, Bureaus and laboratories arrived at the decision that at the present time the research should be along magneto chemical lines. After completion of this research, in about one year, the electronic and instrumentation problems connected with a paramagnetic resonance magnetometer will be attacked. In the meantime, BuAer will continue development of the ASQ-8.[45]

Project Hartwell

Along with its specific recommendations, the Report included a set of more subjective General Recommendations. These addressed creation of a naval systems engineering organization which would work both within and between the material bureaus. Ultimately, the Material Command and PM4 would serve this function starting in the early sixties. The Report commented that the "present Navy program for hydrofoil research and development seems excellent." This was twenty-seven years before the first PHM was commissioned. There was the recommendation that electronics reliability goals be observed and not subverted; and that the scope of intelligence techniques be expanded since "if we have poor intelligence the scale of our effort must be greater since we must then provide countermeasures for all possible weapons instead of all probable weapons."[46]

Op-03

With regard to the General Recommendations of the Hartwell Report, Op-03 found that system integration to the degree required existed within each bureau. Larger systems integration concepts were "a primary function of the Chief of Naval Operations." In other words, a special systems organization was not required. With regard to the suggested expansion of intelligence, the Navy was accomplishing this within the limits of available facilities. The electronics reliability problems summarized by the report



RFCAL

USS Cabot *(CVL 28) in August 1951, with nine Grumman AF Guardians on deck.*

had led to the establishment of the Office of "Coordinator of Electronics Programs" under the Vice Chief of Naval Operations.[47]

In brief, the Hartwell Report summarized the recommended advances in ASW technology primarily from the scientists' point of view at the start of the Korean War. That war provided much of the impetus which would make many of those recommendations a reality over the next decade.

1950

Refinements in the Navy's ASW Organizations

The Hunter-Killer Concept Grows

Organizationally during 1950 the Atlantic Fleet in consonance with its increased antisubmarine responsibilities created the Mobile Hunter-Killer Force (CTF 81), three semipermanently constituted groups, each comprising one CVE or CVL and one destroyer squadron.[48] Command of CTF 81 at this time resided with COMCARDIV 16, Rear Admiral R.E. Blick, who reported in turn to CTF 80, Commander, Antisubmarine Force. This, the most senior ASW command in the Atlantic Fleet, although normally not activated, was the direct responsibility of the Commander in Chief, Atlantic Fleet himself.* This arrangement was further refined under the new CINCLANTFLT, Admiral Linde D. McCormick, on 7 January 1952 when CTF 81 officially became Hunter-Killer Force U.S. Atlantic Fleet and TF 80 was assigned the newly created Ocean Subarea, essentially everything outside the Atlantic Sea Frontiers. Thus, the Hunter-Killer Forces could operate under the control of the Sea Frontier Commanders while in their areas of responsibility, but on the open ocean they were directly responsive to CINCLANTFLT.

1951

Increased ASW Responsibilities in the Fleets

On 12 July 1951 the Chief of Naval Operations, Admiral Sherman, further increased both Fleets' ASW responsibilities by transferring all ASW and shipping control to those commands. This effectively took the CNO out of the operational end of the ASW business, that organization's only remaining responsibility being to provide adequate intelligence to the Fleet commanders. With this arrangement the Fleet ASW forces both operated under the direct control of each Commander in Chief. Commenting on the proposed change before it became effective, Rear Admiral Frank Akers, who had replaced RADM Momsen as ACNO (Undersea Warfare), Op-31 stated:

> ACNO (Undersea Warfare) does not favor any plan which tends towards the TENTH Fleet concept through the centralization at the CNO level of controls which could be delegated to the Fleet Commanders and considers that improved ASW readiness and economy of forces will result by continuing to place oceanwide responsibility for ASW and Shipping Control in CINCPACFLT and CINCLANTFLT.[49]

* Admiral William M. Fechteler.

1953

In January 1953 Admiral Radford, then CINCPACFLT, proposed establishment of the THIRD Fleet, organized to function much like the TENTH Fleet of World War II in ASW matters. Designed to be active only during periods of conflict, it was to have its own staff headed by a senior vice admiral. At other times the THIRD Fleet mission was to be assumed by the Assistant Chief of Staff for Operations. Internally within the PACFLT staff there was considerable opposition to this concept by those with both TENTH Fleet and Op-31 experience who felt that such an organization would cut across the normal naval command entities within both the Navy Department and the Fleets, inevitably resulting in conflict and confusion. It was stated that the TENTH Fleet had been successful "only because there was no other types of major naval operations in the Atlantic at the time." Despite these misgivings by members of his staff, CINCPACFLT on 8 July 1953 officially requested the concurrence of CNO in establishing the THIRD Fleet at such time as the ASW problem so dictated along with his approval of the THIRD Fleet staff mobilization requirements. At the Antisubmarine Plans and Policies Group* meeting in October 1953 Captain F.D. Giambattista, then Op-312, commented:

The Pacific Fleet Considers the TENTH Fleet Concept

> The TENTH Fleet as conceived in World War II is very much in disfavor in the Navy Department today and some time ago this was recognized and CNO gave the Fleet Commanders full control of the ASW activity in their respective oceans along with the control of shipping.[51]

TF 30 Established

The Pacific ASW organization as finally approved by OPNAV allowed the establishment of TF 30, but did not provide for the senior billets or staff requirements originally requested. In 1953 the operations of both Fleet Hunter-Killer forces, HUKLANT and HUKPAC, were summarized by Op-312:

> Initially it would appear that the Hunter-Killer groups will be employed in direct

* With the outbreak of the Korean War, the formal Anti-Submarine Conferences held in the fall of each year since 1946 were discontinued. Op-312 retained authority of this function by conducting informal Antisubmarine Plans and Policies Group meetings. The mission of the Antisubmarine Plans and Policies Group was to study and advise on matters pertaining to antisubmarine policies.[50] The Antisubmarine Plans and Policies Group met throughout the 1950s, and was dissolved in 1959 when a formal Anti-Submarine Conference was convened in May of that year.

1953 Assessment of the Hunter-Killer Group

> support of shipping; that is, as a convoy support group, because of the paucity of escorts, both air and surface, and because of the fact that we may not have the good intelligence that we need to operate Hunter-Killer groups effectively. As their employment in Hunter-Killer operations will be prosecuted primarily, they will be in the open ocean regions outside the effective ranges of the shore-based aircraft.[52]

Thus both the Atlantic and Pacific Fleets had similar ASW organizations directly responsible to their respective Commanders in Chief. Each Fleet commander could delegate ASW responsibilities to appropriate Sea Frontier Commanders, but both maintained direct, if nominal, control over the mobile Hunter-Killer forces.

Expansion of LANTFLT ASW

On 6 November 1954 CINCLANTFLT enlarged its Hunter-Killer force to four Mobile Groups under one senior flag officer and three subordinate CARDIV commanders. The tasks of this force were expanded, CNO approval being received to change its title to Antisubmarine Force, U.S. Atlantic Fleet.

The Beginning of SOSUS

Coincident with the arrival of the CVS, the Navy's long range underwater surveillance system, SOSUS, came into being. It was tested operationally in the Atlantic for the first time from 26 April to 7 June 1954 (ASDEVEX 1-54) with promising results. It was concluded by CINCLANT that "LOFAR (SOSUS) will prove a valuable source of information for ASW operations."*[53] LOFAR (Low Frequency Analyzing Recorder) had its inception in the fall of 1950. At that time a research contract for its development was awarded to the Western Electric Company, which assigned the work to its research organization, the Bell Telephone Laboratories at Murray Hill, New Jersey. ONR was directed by OPNAV to handle all aspects of this passive detection project code named "Operation CAESAR," which would eventually become SOSUS (Sound Surveillance System). At the time of the

Bell Telephone Laboratories Start Work

1950

* During ASDEVEX 1-54, the first Sound Surveillance System (SOSUS) employed by the U.S. Navy was operated to investigate and develop the best methods and procedures for operating such a system. In this SOSUS network land-based stations connected to long lines of passive hydrophones were capable of detecting snorkelling or surfaced submarines by exploiting their low frequency ship engine noise.

contract, the feasibility of the LOFAR concept had been theoretically demonstrated in an analysis made in late 1950 by Bell Telephone Laboratories. By 2 May 1951, the first working model was produced and the first shore installation implanted in shallow water off Sandy Hook, New Jersey. The performance of this laboratory tool was excellent, with detection ranges of forty to fifty miles obtained in relatively shallow water. ONR then authorized a deep water installation and by January 1952 the first forty hydrophone array was installed in 200 fathoms of water off Eleuthera in the Caribbean. The Eleuthera Array was ready to begin testing in April 1952 against submarines and surface craft operating offshore. As a result of these tests, a directive was issued by CNO in June 1952 to the Bureau of Ships to procure and install six operating stations along the Atlantic Coast. By the time ASDEVEX 54-1 was held in April 1954 the experimental LOFAR stations at Eleuthera and Bermuda, along with the new submarine USS K-1, equipped with advanced long range sonar listening gear, furnished target detection information to the SOSUS control center at Norfolk. Passive sonobuoy-equipped aircraft were then dispatched to the reported point of detection. Success was achieved in making contact with the snorkelling target submarine 90 percent of the time.

1951

1952

The Eleuthera and Bermuda Installations

Impressive Success

Despite this promising performance, the estimated completion date of the first fully operational SOSUS network in the Atlantic was December 1956 while the first Pacific systems would not be available until March 1958.[54] The need for SOSUS or some other detection system like it confirmed the fundamental truths restated by CAPT Giambattista just as the CVS forces, SOSUS, and centralized ASW organizations in both fleets were coming into being:

Operational Dates

> Hunter-Killer forces are only used where there is a definite intelligence that there is the presence of a submarine or submarines. That is the only time they are a Hunter-Killer group as such. In the absence of that intelligence, they will be used in close support or direct support of convoys. That is where we and the British differ in concept of deployment of Hunter-Killer forces. They feel that the Hunter-Killer groups should be used in direct support of convoys. We feel if we have intelligence on the location of submarines, we will deploy our Hunter-Killer forces independently of the convoy and direct attack on the submarines.[55]

SOSUS and the HUK Groups

ASW Weapons, Sensors, and Aircraft 1950-1954

Sonobuoys

During the 1950-54 period ASW sensors and weapons had developed slowly. The sonobuoys carried were the nondirectional passive SSQ-2. It had proved something of a disappointment, particularly when used for anything other than simple detection. However, it had its defenders in Washington who summed up the age old problem of trying to get more out of what you've got. As reported by CAPT Lanham at the Antisubmarine Plans & Policy Group meeting in March 1953, the SSQ-2 sonobuoy was designed to be "dropped in the water to let us know if a cavitating submarine was present. That is the only thing it was designed for but because we didn't have anything else in the family of buoys either passive directional, or active directional, we are trying to make this buoy do things it was not designed for."[56]

Torpedos

Antisubmarine weapons were another deficiency. The Mk 41 Mod 1 torpedo was under development as well as the Mk 34 and the new, smaller Mk 43. However, only the Mk 34-1 torpedo, released for service use in July 1952 as replacement for the Mk 24 mine, was available in adequate numbers. Everything else in use in the fleet was of World War II vintage.[57]

MAD

Improved MAD during 1953 and 1954 rapidly made its operational appearance, the MAD gear in the S2F--the ASQ-8--having a plant range of 1,000 feet. The S2F itself began large quantity delivery to fleet squadrons in the latter half of 1953, and was combat-equipped by early 1954. By June 1954 two of the nine VS squadrons in the Atlantic had been re-equipped with S2F "single package" aircraft. The AF-3S with fuselage mounted MAD was introduced early in 1954 but only forty of these aircraft were built before deliveries ended. The S2F had arrived and would stay for twenty years.

S2F

Naval Institute

One of the first operational S2F-1's.

Naval Institute

One of the HUP-2 ASW conversions. Many were planned but only a few performed in this role because of their limited size - 5,440 pounds.

HFCAL

An HSS-1 dipping its AQS-4 sonar.

Helicopters

ASW helicopters, propelled by the operational and financial pressures of the Korean War, made rapid progress during this short period. Basically conceived as a stable screening element to the convoy or task force, the Navy's first operational dipping sonar helicopter was the Piaseki HUP-2S, introduced in March 1952. These craft were followed by twenty-four of the earlier Sikorsky HRS helicopter, initially procured for the assault role by the Marine Corps. These were reacquired from the Marines, modified to include dipping sonar and divided evenly between AIRLANT and AIRPAC with delivery starting in April 1953. Prior to this, in 1952 the CNO sent down its second requirement (ASW No. 2) for an ASW helicopter capable of staying on station for six hours while carrying sonar, MAD and armament. Endurance was a major problem with the existing designs but flight control was improving. A helicopter automatic pilot had been demonstrated and automatic altitude and positioning equipment were under development. All-weather ASW helicopters capable of night operations were coming, but at this point were still in the future.

By early 1953 the Bell version of the ASW No. 2 Requirement, after extended development delays, was dropped, replaced by the Sikorsky XHSS-1 Seabat, which made its first flight in March 1954. This 14,000-pound machine was to be the standard ASW helicopter aboard the antisubmarine carriers from 1955 until the SH-3 series replaced it six years later in 1961.

Summary

In summary, the Korean War period served to revitalize the Navy's ASW sea-based airborne arm. Although no submarines were ever engaged during the Korean conflict to forcefully emphasize their deficiencies, the World War II equipment with which the Navy had been forced to live--the CVE, the TBM, and the Mk 24 mine--gave way to the CVS, the S2F aircraft and improved armament and sensors. The complex and delicate helicopter made its initial operational appearance in the ASW role; SOSUS as a passive long range detection device came into being in the Atlantic, and the Fleet ASW organizations were strengthened to provide more effective ties between the new intelligence gathering systems and the more effective Hunter-Killer forces now appearing on the scene. This occurred just as the Soviets were providing hard evidence that they had indeed developed a new fleet of postwar submarines.

The Korean War

What it All Means

Money and experience proved once again to be decisive factors on the road to ASW success. Korea showed the limitations of the CVE and allowed the postwar carrier program to finally move so that the ESSEX carriers could serve usefully in the Hunter-Killer role. The limitations of sonar accelerated the development of the ASW helicopter while the S2F arrived as the Navy's first all-around carrier based ASW aircraft.

The Soviets still gave no substantial indication of their postwar submarine programs, so much of the Navy's planning was based on intelligence estimates. The Pacific and Atlantic Fleets acquired stronger, more centralized ASW responsibility and strengthened their ASW organizations as a result. While the Soviets failed to test the ASW waters during Korea, that war did provide impetus to ASW modernization, the pressures for which would increase as the Russian threat became more specific.

References

1. Secret CINCPAC Interim Evaluation Report No. 1, dated 25 June 1950 to 15 November 1950, NHC/AR, p. 349.

2. CINCPAC Interim Evaluation Report No. 1, p. 354.

3. CINCPAC Interim Evaluation Report No. 1, p. 349.

4. CINCPAC Interim Evaluation Report No. 1, p. 349.

5. CINCPAC Interim Evaluation Report No. 1, p. 168.

6. CINCPAC Interim Evaluation Report No. 1, p. 207.

7. CINCPAC Interim Evaluation Report No. 1, p. 210.

8. CINCPAC Interim Evaluation Report No. 1, p. 212.

9. Op-313 Secret Memorandum for Distribution List, Op-313 1953 Shipbuilding and Conversion Program, 21 February 1951, Op-313, File A1-1, Serial 00143P3, NHC/AR.

10. CINCPAC Interim Evaluation Report No. 1, p. 346.

11. CINCPAC Interim Evaluation Report No. 1, p. 346.

12. Secret CINCPAC Interim Evaluation Report No. 2, dated 16 November 1950 to 30 April 1951, p. 810.

13. CINCPAC Interim Evaluation Report No. 2, p. 812.

14. Secret CINCPAC Interim Evaluation Report No. 3, dated 1 May 1951 to 31 December 1951, p. 6-3.

15. Secret CINCPAC Interim Evaluation Report No. 4, dated 1 January 1952 to 30 June 1952, p. 5-38.

16. CINCPAC Interim Evaluation Report No. 4, p. 5-39.

17. CINCPAC Interim Evaluation Report No. 4, p. 5-41.

18. COMCARDIV 17 Secret Memorandum to CINCPACFLT, 19 May 1952, File A16-8, Serial 077, Record Group 38, W.N.R.C.

19. Secret CINCPAC Interim Evaluation Report No. 5, dated 1 July 1952 to 31 January 1953, p. 5-83.

20. CIN` ‹C Interim Evaluation Report No. 5, p. 5-58.

21. Secret CINCPAC Interim Evaluation Report No. 6, 1 February 1953 to 27 July 1953, pp. 5-175 and 5-176.

22. CINCPAC Interim Evaluation Report No. 6, pp. 5-159, 5-160, and 5-161.

23. Anti-Submarine Plans and Policies Group, 4 March 1953, Op-312 File, Record Group 38, W.N.R.C., p. 22. (Secret).

24. Anti-Submarine Plans and Policies Group, 4 March 1953, p. 24.

25. Anti-Submarine Plans and Policies Group, 4 March 1953, p. 22.

26. Project Hartwell, "A Report on Security of Overseas Transport," 21 September 1950, Vol. 1, NHC/AR, pp. K-1 and K-2. (Secret).

27. Project Hartwell, Vol. I, p. ii.

28. Tenth Proceedings National Security Industrial Association/Navy ASW Conference, 20/21 May 1970, Serial 5-70, (Washington, D.C.: State Department,) p. 100.

29. Project Hartwell, Vol. I, p. 2.

30. CNO Secret letter to Op-31, 30 November 1950, Serial 00438P31, Record Group 38, W.N.R.C.

31. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, File A1-1, Serial 00272P31, Record Group 38, W.N.R.C.

32. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 2.

33. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 3.

34. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 3.

35. DCNO (Operations) Secret Memorandum to CNO, 3 May 11951, Enclosure (1), p. 4.

36. Anti-Submarine Plans and Policies Group, 4 March 1952, Op-312 File, Record Group 38, W.N.R.C., pp. 23-24. (Secret).

37. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 6.

38. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 7.

39. DCNO (Operations) Secret Memorandum to CNO 3, May 1951, Enclosure (1), p. 8.

40. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 16.

41. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 17.

42. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 18.

43. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 19.

44. DCNO (Operations) Secret Memorandum to CNO, 4 May 1951, Enclosure (1), p. 20.

45. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), p. 32.

46. Hartwell Report, p. 13.

47. DCNO (Operations) Secret Memorandum to CNO, 3 May 1951, Enclosure (1), pp. 34-42.

48. Annual Report of CINCLANTFLT, 1 February 1950 to 30 June 1950, File FF13/A9-8, Command File, NHC/AR, p. 3. (Secret).

49. ACNO (Undersea Warfare) Secret Memorandum for DCNO (Operations), 24 May 1951, Op-312F, Serial 0042P31, NHC/AR.